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PRESENTATION/POSTER

DIFFERENT DEGREES OF EFFECTS OF PAUSES ON ENGLISH RATE PERCEIVED BY ENGLISH AND JAPANESE SPEAKERS

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Pausing is a very important factor when listeners judge the speaking rate. However, pause frequencies are quite different between English and Japanese languages. Roughly speaking, Japanese has three times as many pauses per sentence as English (Anderson-Hsieh & Venkatagiri, 1994). Another difference is that English has a 'rallentando' or a slowing down throughout the intonation phrase (Dankovicová, 1999), while Japanese has mora timing, where every mora is pronounced at approximately the same rate throughout an utterance (Han, 1962; Homma, 1981; Minagawa-Kawai, 1999; Port, Al-Ani, & Maeda, 1980; Sato, 1993). Due to such differences, the degrees of effects of pauses on perceived rate of English could be different. This hypothesis was tested with an experiment. Pairs of English passages, which were identical in physical rate but different in pause frequency, were presented to Japanese speakers and English speakers, who were asked to indicate which passage sounded faster or the same. The results showed that low pause frequency passages tended to be perceived as faster by both Japanese and English speakers. However, there was a higher proportion of Japanese speakers who judged low pause frequency passages as faster in speech rate compared to English speakers. Therefore, pauses appear to have a stronger impact on rate perception by Japanese speakers than English speakers because English speakers take advantage of rallentandos as well as pauses to detect syntactic boundaries while pauses are the only syntactic boundary marker which Japanese speakers can take advantage of.

INTRODUCTION

It is believed that some languages are spoken more quickly than others (Roach, 1998). English is among those languages which are believed to be spoken faster, at least from Japanese listeners' point of view (Griffiths, 1992). Although there might be several reasons that contribute to such beliefs, I propose that the ways pauses function in an utterance play an important role in how Japanese and English speakers perceive English speech rate.

Previous researchers argued that pausing is a very important factor when listeners judge the speaking rate (Den Os, 1988; Feldstein & Bond, 1981; Grosjean & Lane, 1974; Lass, 1970). However, how important the function of pauses as a syntactic boundary maker seem to be different between English and Japanese.

First, the number of pauses in Japanese and English sentences differ significantly. The mean number of pauses per sentence in English spoken by native speakers is zero for short and medium sentences and 0.67 for long sentences (Anderson-Hsieh & Venkatagiri, 1994). On the other hand, the mean number of pauses per sentence in Japanese is 1.8 (Kaiki & Sagisaka, 1996). Roughly speaking, Japanese has three times as many pauses as English.

In addition, pauses are usually placed on major syntactic boundaries (Hawkins, 1971; Ishizaki, 2005; Viola & Madureira, 2008). They tend to function as an indicator of major syntactic boundaries and help listeners understand utterances more easily. Since pauses occur three times as frequently in a Japanese utterance as an English one, it is possible that these pauses serve a more important role for Japanese speakers than English speakers.

English speakers, on the other hand, do not use as many pauses as an indication of syntactic boundaries due to the fact that English has a 'rallentando' or a slowing down throughout the intonation phrase (Dankovicová, 1999) (See Figure 1), which also indicates syntactic boundaries.

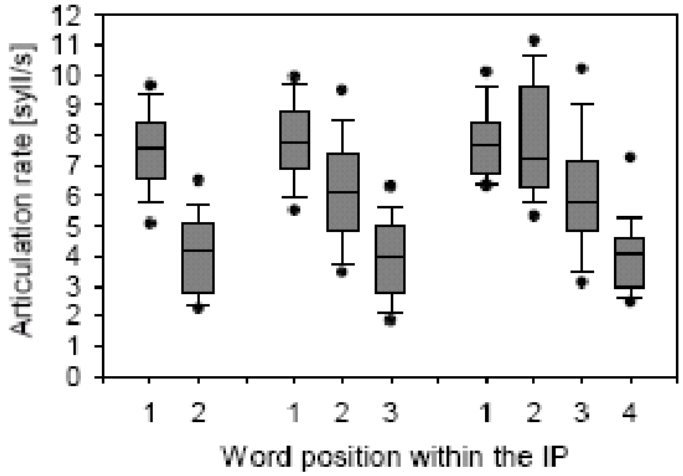

Figure 1. Word articulation rate in different positions within intonation phrase (English) (Dankovicová, 1999).

Considering that short and medium sentences are usually spoken without any pauses (Anderson-Hsieh & Venkatagiri, 1994), the function of pauses as a syntactic boundary marker is not very important in English. Instead, the function is mostly undertaken by rallentandos.

Research question

Since the function of pauses as a syntactic boundary marker is not the same in its importance between English and Japanese, it can be hypothesized that pauses affect perception of rate differently between English speakers and Japanese speakers. My research question is: Do pauses have a stronger impact on rate perception by Japanese speakers than English speakers?

METHODS

Participants

Twenty-two native Japanese speakers (4 males and 18 females) participated in the experiment. They were all undergraduate students of a university in Tokyo, Japan, all of whom majored in English. Their English proficiency was at a lower intermediate level on average. As a control group, 25 native English speakers (25 females) participated in this study. They were all

undergraduate students of a university in Sydney, Australia. None of them had studied Japanese as a foreign language prior to the experiment. None of the participants had any hearing loss or hearing impairment.

Although Feldstein, Dohm, and Crown (1993) concluded that females tend to judge speech rates to be faster than men do and the results of this study are subject to be potentially biased for the English speakers due to the fact that they were all female, I would argue that the nature of the task will eliminate such doubt. In their experiment, the task was to estimate the rates of speech on a 7-point scale. In this experiment, however, the task was to compare rates, not to estimate rates as will be explained in the procedure section. Hence, even if females overestimate the rates of a pair of tokens, they could fairly compare pairs of tokens and judge which is faster or the same just the same way as male participants would do. Comparison of rates by females will not be biased due to their overestimation of rates compared to males.

Stimuli

Fifteen English passages, previously used for the speaking section in the Test in Practical English Proficiency (EIKEN) Grade 3, were selected as the materials for the speech stimuli. Each passage was composed of three sentences. The "EIKEN" is a leading language assessment in Japan and Grade 3 is recognized as a benchmark proficiency level for junior high school graduates, which is equivalent to CEFR level A1. Although all passages in the speaking section of the Grade 3 tests are supposed to be easily understood by Japanese college students in general, comparatively easy passages were selected as the materials for the tokens to exclude parsing effects as much as possible. If they are too difficult to understand, the participants may start wondering whether they are judging rate or comprehensibility. All the stimuli were synthesized with the Festival Speech Synthesis System (Black & Clark, 2003).

Two types of pause treatment were implemented to each passage. For the first type of treatment, passages had two intersentence pauses only, the length of which was around 1000ms. For the second type of treatment, passages had three intrasentence pauses in each sentence in addition to the two intersentence pauses. The duration of the intrasentence pause was fixed at 150ms while that of the intersentence pause was at 300ms. Prior to the pause distribution modification, the speech parts of the paired passages had been controlled so that both had the same duration. Then, the two versions of the same passage with different treatment of pauses were paired together to be presented to the participants. Thus, paired passages had exactly the same speech duration and pause duration. The only difference was pause distribution. One had only two pauses and the other had 10 to 12 pauses.

The locations of the pauses were carefully planned as well. Pauses after a long sequence of continuous speech will add more cognitive load on memory than those after a short speech stream due to the word-length effect on working memory (Baddeley, Thomson, & Buchanan, 1975). In turn, variations of memory load could affect rate perception. Hence, to control for an equal cognitive load on memory for the listeners, the intrasentence pauses were placed so that the intervals may roughly be the same. In addition, although natural speech could have been used with modifications such as pause insertion and deletion, it was not used because such modifications would possibly result in unnaturalness due to discontinuous intonation contours.

An example of the paired passage tokens is shown below with the locations of the pauses marked. Intersentence pauses are indicated by <<P>> and intrasentence pauses are indicated by <p>.

Beach passage

The sea is a popular place to go in summer. <<P>> Some people enjoy sunshine on the beach and others play in the cool water. <<P>> Everyone can have a good time together.

The sea <p> is a popular place <p> to go <p> in summer. <<P>> Some people <p> enjoy sunshine on the beach <p> and others <p> play in the cool water. <<P>> Everyone <p> can have <p> a good time <p> together.

Procedures

For the Japanese participants, the experiment was conducted on one participant at a time in a quiet room using Praat (Boersma & Weenink, 2009). During the experiment, the participant was seated in front of a computer screen showing three rectangles lined up horizontally which were labelled "1st", "same", "2nd" from left to right meaning respectively "the first stimulus sounds faster than the second one"," both sound the same", and "the second stimulus sounds faster than the first one". Fifteen pairs of English passages, one of which was a high pause frequency passage and the other was a low pause frequency passage, were randomly presented twice in different orders to the participant over headphones with an interval of 0.5s between the paired stimulus passages. The participant was asked to indicate which sequence of a given pair sounded faster or if both sounded the same in terms of speech rate by clicking one of the three rectangles on the screen. The order of presentation of the stimulus pairs were counterbalanced across the participants. The total number of trials was 30 for each participant.

For the English speakers, the experiment was conducted in small groups of two or three in the perception experiment room at a university in Sydney, Australia. The experiment was administered on paper. The stimulus passages were presented to the English speakers over headphones just the same way as to the Japanese speakers except that the order of presentation of the stimulus pairs was not counterbalanced across the participants. They were asked to indicate their responses on a sheet of paper by circling one of the three options ("1st faster", "same", "2nd faster") printed on it. The three options corresponded to the three response rectangles presented to the Japanese speakers.

Different experimental designs were used for Japanese speakers and English speakers due to the time constraints on my visit to Australia. The experiments were conducted on groups of Australian subjects rather than individually to collect more data in shorter time. In addition, no computer software was used for the Australian subjects because no software was available for groups of subjects.

RESULTS

The binomial test was carried out for an alpha level of 0.05 to determine the effect of frequency of pauses on Japanese and English listeners' perception of English speech rates. The results show

that in most cases Japanese speakers perceived the low pause frequency passages as faster than the high pause frequency passages, as shown in Table 1, where 11 out of 15 results tested significant. English speakers also perceived the low pause frequency passages as faster than the high pause frequency passages in some cases, but not as often as Japanese speakers as shown in Table 2, where seven out of 15 results tested significant.

Table 1

Number of Japanese speakers' responses having indicated that the low pause frequency passage was faster, the high pause frequency passage was faster, and both sounded the same

Passage name	Low pause frequency	High pause frequency	same	Test results
beach	19	8	17	* (p= .026)
bike	26	5	13	** (p< .001)
cleaning	19	12	13	
cleanup	24	6	14	** (p< .001)
cooking	23	8	13	** (p= .005)
earth	27	10	7	** (p= .004)
fastfood	14	16	14	
foreign	15	8	21	
internet	26	7	11	** (p< .001)
library	25	5	14	** (p< .001)
picture	22	10	12	* (p= .025)
present	13	9	22	
rainy	27	5	12	** (p< .001)
river	28	7	9	** (p< .001)
spring	24	10	10	* (p= .012)
Total	332	126	202	

Table 2

Number of English speakers' responses having indicated that the low pause frequency passage was faster, the high pause frequency passage was faster, and both sounded the same

Passage name	Low pause frequency	High pause frequency	same	Test results
beach	17	16	17	
bike	15	21	14	
cleaning	19	15	16	
cleanup	28	10	12	** (p= .003)
cooking	13	17	20	
earth	27	11	12	** (p= .007)
fastfood	20	14	16	
foreign	14	19	17	
internet	32	10	8	** (p< .001)
library	26	12	12	* (p= .017)
picture	28	13	9	* (p= .014)
present	17	18	15	
rainy	29	8	13	** (p< .001)
river	36	9	5	** (p< .001)
spring	26	16	8	
Total	347	209	194	

Then, a chi-square test of goodness-of-fit was performed for an alpha level of 0.05 to determine whether the low and high pause frequency passages were equally judged to be faster. The Japanese speakers' responses were not equally distributed, $\chi 2$ (14, N=458) = 111.41, $p < .01$. The English speakers' responses were not equally distributed, either, $\chi 2$ (14, N=556) = 71.81, $p < .01$. The results indicate that the low pause frequency passages were judged to be faster than the high pause frequency passages by both the Japanese and the English speakers.

Furthermore, the 2-sample test for equality of proportions revealed that there was a significant difference between the proportions of the Japanese and English speakers who judged that the low pause frequency passage was faster than the high pause frequency passage ($p < .001$). The proportion of the Japanese speakers who judged that the low pause frequency passage was faster was greater than that of the English speakers.

DISCUSSION

Although contribution of pause frequency to rate perception was already reported by Grosjean & Lane (1974) and Grosjean & Lane (1976), there was a methodological flaw in their studies, as

increasing/decreasing the number of pauses meant decreasing/increasing the speaking rate. To address this issue the paired passages used in the present experiment had exactly the same articulation rate and speaking rate in terms of any unit commonly used for rate measurement. Nonetheless, the results show that the low pause frequency passages were perceived as faster than the high pause frequency passages. Also the ratio of Japanese speakers who judged the low pause frequency passages as faster was higher than that of English speakers. In other words, two passages having exactly the same physical rate could be perceived as different in rate by Japanese and English speakers when pauses are distributed differently, and the frequency of pauses has a stronger impact on rate perception by Japanese speakers than English speakers. Why?

Japanese speakers' expectation and memory span

People try to listen to a second language through the ears of a first (Cutler, 2000). Since intrasentence pauses function as a major clue for Japanese speakers to detect syntactic boundaries in Japanese, Japanese speakers may well expect pauses to occur as often as Japanese even when they listen to English.

Therefore, without pauses Japanese speakers may experience difficulties in identifying the syntactic boundaries in English. They would have more difficulties understanding the structure of a sentence and its meaning, which causes processing delay. Moreover, memory span is shorter in a foreign language than in the native language (Lado, 1965). This would further slow down Japanese speakers' English processing rate. Although processing delay may be compensated for by insertion of the intrasentence pauses, they do not appear very often in English. Japanese speakers may try to make up for the processing delay by taking advantage of a few intersentence pauses. Yet, more often than not, before they are able to do so, the next sentence goes into their ears without mercy. That could be one of the reasons why Japanese speakers perceive English as faster when there are fewer pauses.

Rallentando advantage

On the other hand, English speakers may take advantage of the presence of rallentandos as a marker of syntactic boundaries, using intrasentence pauses as a secondary boundary marker. Although the intrasentence pauses also provided information about syntactic boundaries, their contribution to comprehension was not very great for English speakers because they were already given enough information about syntactic boundaries by virtue of rallentandos.

The high pause frequency passages had longer sentences (including pauses) than the low pause frequency passages because the latter had no intrasentence pauses. The high pause frequency passages, on the other hand, had shorter intersentence pauses (300 ms) compared to those of the low pause frequency passages (1000 ms). According to Lass (1970), intersentence pause time alterations show greater changes in rate perceived by English speakers than intrasentence pause time alterations. Frequent intrasentence pauses decreased perceived rate but the shorter intersentence pause time may have increased the perceived rate. Hence, intra- and intersentence pauses may have cancelled each other in their effects on perceived rate by English speakers.

Japanese speakers, on the other hand, may have tried very hard to detect syntactic boundaries especially when they listened to the passages without intrasentence pauses. Unlike English speakers, however, Japanese speakers lack the ability to identify syntactic boundaries through rallentandos. Intrasentence pauses then become the sole cues for Japanese speakers to take on to detect syntactic boundaries.

Why no rallentando in Japanese?

The higher pause frequency could be a language-specific feature of Japanese, which is not just a habit or a favorite style of Japanese way of speaking but a logical consequence of the timing feature of Japanese.

Rallentando is not allowed in Japanese because it is a mora-timed language. Oono and Miwa (1996) measured the sentence initial and sentence final mora durations of Japanese read by a professional narrator. They found that the durations were the same at both sentence initial and sentence final positions. Japanese speakers usually pronounce every mora at approximately the same rate throughout an utterance. Slowing down would disturb the mora-timing.

There has been a lot of controversy over whether the Japanese mora is really isochronous or not (Warner & Arai, 2001). While much evidence has been reported against isochrony of the Japanese mora (Beckman, 1982; Campbell & Sagisaka, 1991; Hoequist, 1983; Otake, 1988, 1989), evidence for isochrony has been reported as well by many researchers (Han, 1962; Homma, 1981; Minagawa-Kawai, 1999; Port et al., 1980; Sato, 1993). It would be impossible to achieve complete isochrony in any language. Although Japanese speakers are not speaking like a metronome and durational variation is acceptable to a certain degree, slowing down of a Japanese sentence at the end of each intonational phrase would modify the time component of Japanese to the extent that it does not sound natural. In an extreme case, it might cause misunderstanding because long and short vowels are distinctive in Japanese: ho “canvas”, hoo “cheek”, hoooo “pontiff”. Since Japanese is not allowed to slow down, it chose to insert pauses from time to time instead.

CONCLUSIONS

Since English speakers locate syntactic boundaries mostly using rallentandos, pauses are not always necessary for them to process the sentence. Adding more pauses may not help English speakers understand an utterance better.

On the other hand, Japanese speakers may not be familiar with rallentandos in English and their function as a syntactic boundary marker. Therefore, pauses may help Japanese speakers detect syntactic boundaries more easily while the presence of rallentandos may not help at all. With fewer pauses, Japanese speakers would have more trouble understanding the structure of an utterance, which causes processing delay and makes it sound faster. Thus, my hypothesis was confirmed: pauses have a stronger impact on rate perception by Japanese speakers than English speakers.

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REFERENCES

Anderson-Hsieh, J., & Venkatagiri, H. (1994). Syllable duration and pausing in the speech of Chinese ESL speakers. *TESOL Quarterly, 28*(4), 807-812.

Baddeley, A. D., Thomson, N., & Buchanan, M. (1975). Word length and the structure of short-term memory. *Journal of Verbal Learning and Verbal Behavior, 14*(6), 575-589. doi:10.1016/S0022-5371(75)80045-4

Beckman, M. (1982). Segment duration and the 'Mora' in Japanese. *Phonetica, 39*(2-3), 113-135.

Black, A. W., & Clark, R. (2003). The Festival Speech Synthesis System (Version 1.4.3). Retrieved from http://www.cstr.ed.ac.uk/projects/festival/

Boersma, P., & Weenink, D. (2009). Praat: doing phonetics by computer (Version 5.1.05). Retrieved from http://www.praat.org/

Campbell, N., & Sagisaka, Y. (1991). Moraic and syllable-level effects on speech timing. (Onsei taimingu ni mirareru moora to onsetsu no eikyou ni tsuite) "音声タイミングにみられるモーラと音節の影響について ". Trans. Committee Speech Res., *Acoust. Soc. Japan 『電子情報通信学会技術研究報告』, SP90*, 35-40.

Cutler, A. (2000). Listening to a second language through the ears of a first. *Interpreting, 5*(1), 1-23. doi:10.1075/intp.5.1.02cut

Dankovicová, J. (1999). Articulation rate variation within the intonation phrase in Czech and English. *ICPhS99*, 269-272.

Den Os, E. A. (1988). Rhythm and tempo of Dutch and Italian: A contrastive study. (PhD), University of Utrecht, The Netherlands.

Feldstein, S., & Bond, R. N. (1981). Perception of speech rate as a function of vocal intensity and frequency. *Language and Speech, 24*(4), 387-394. doi:10.1177/002383098102400408

Feldstein, S., Dohm, F.-A., & Crown, C. L. (1993). Gender as a mediator in the perception of speech rate. *The Bulletin of the Psychonomic Society, 31*(6), 521-524.

Griffiths, R. (1992). Speech Rate and Listening Comprehension: Further Evidence of the Relationship. *TESOL Quarterly, 26*(2), 385-390.

Grosjean, F., & Lane, H. (1974). Effects of two temporal variables on the listener's perception of reading rate. *Journal of Experimental Psychology, 102*(5), 893-896. doi:10.1037/h0036323

Grosjean, F., & Lane, H. (1976). How the listener integrates the components of speaking rate. *J Exp Psychol Hum Percept Perform, 2*(4), 538-543.

Han, M. S. (1962). The feature of duration in Japanese. *Onsei no Kenkyuu, 10*, 65–80.

Hawkins, P. R. (1971). The syntactic location of hesitation pauses. *Language and Speech, 14*(3), 277-288. doi:10.1177/002383097101400308

Hoequist, C. E. (1983). Parameters of speech rate perception. In K. J. Kohler & C. E. Hoequist (Eds.), *Studies in speech timing* (Vol. 20, pp. 99-138). Kiel: Inst. für Phonetik.

Homma, Y. (1981). Durational relationship between Japanese stops and vowels. *Journal of Phonetics, 9*, 273–281.

Ishizaki, A. (2005). Nihongo no ondoku ni oite gakushusha wa donoyoni pozu o okuka 日本語の音読において学習者はどのようにポーズを置くか. Sekai no nihongo kyoiku 世界の日本語教育, 15, 75-89.

Kaiki, N., & Sagisaka, Y. (1996). Study of pause insertion rules based on local phrase dependency structure. *IEICE Trans., J79-D-II*(9), 1455-1463.

Lado, R. (1965). Memory span as a factor in second language learning. *IRAL - International Review of Applied Linguistics in Language Teaching, 3*(2), 123-130. doi:10.1515/iral.1965.3.2.123

Lass, N. J. (1970). The significance of intra- and intersentence pause times in perceptual judgments of oral reading rate. *J Speech Hear Res, 13*(4), 777-784.

Minagawa-Kawai, Y. (1999). Preciseness of temporal compensation in Japanese mora timing. Paper presented at the *Proceedings of the 14th International Congress of Phonetic Science*.

Oono, M., & Miwa, J. (1996). Rodoku ni okeru pozu to hatsuwa sokudo 朗読におけるポーズと発話速度. *The Journal of the Center for Educational Practice, Research and Training at Iwate University Education Department『岩手大学教育学部附属教育実践研究指導センター研究紀要』* (6), 45-58.

Otake, T. (1988). A temporal compensation effect in Arabic and Japanese. *Bull. phonet. Soc. Japan, 189*(19-24).

Otake, T. (1989). A cross linguistic contrast in the temporal compensation effect. *Bull. phonet. Soc. Japan, 191*, 14-19.

Port, R. F., Al-Ani, S., & Maeda, S. (1980). Temporal compensation and universal phonetics. *Phonetica, 37*(4), 235-252.

Roach, P. (1998). Some languages are spoken more quickly than others. In L. Bauer & P. Trudgill (Eds.), *Language Myths* (pp. 150-158). London: Penguin.

Sato, Y. (1993). The durations of syllable-final nasals and the mora hypothesis in Japanese. *Phonetica, 50*(1), 44-67.

Viola, I. C., & Madureira, S. (2008). The roles of pause in speech expression. *Fourth International Conference on Speech Prosody* (pp. 721-724). Campinas, Brazil.

Warner, N., & Arai, T. (2001). Japanese mora-timing: A review. *Phonetica, 58*(1-2), 1-25.